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2,268,885

SHELF EVAPORATOR

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2 Sheets-Sheet 1

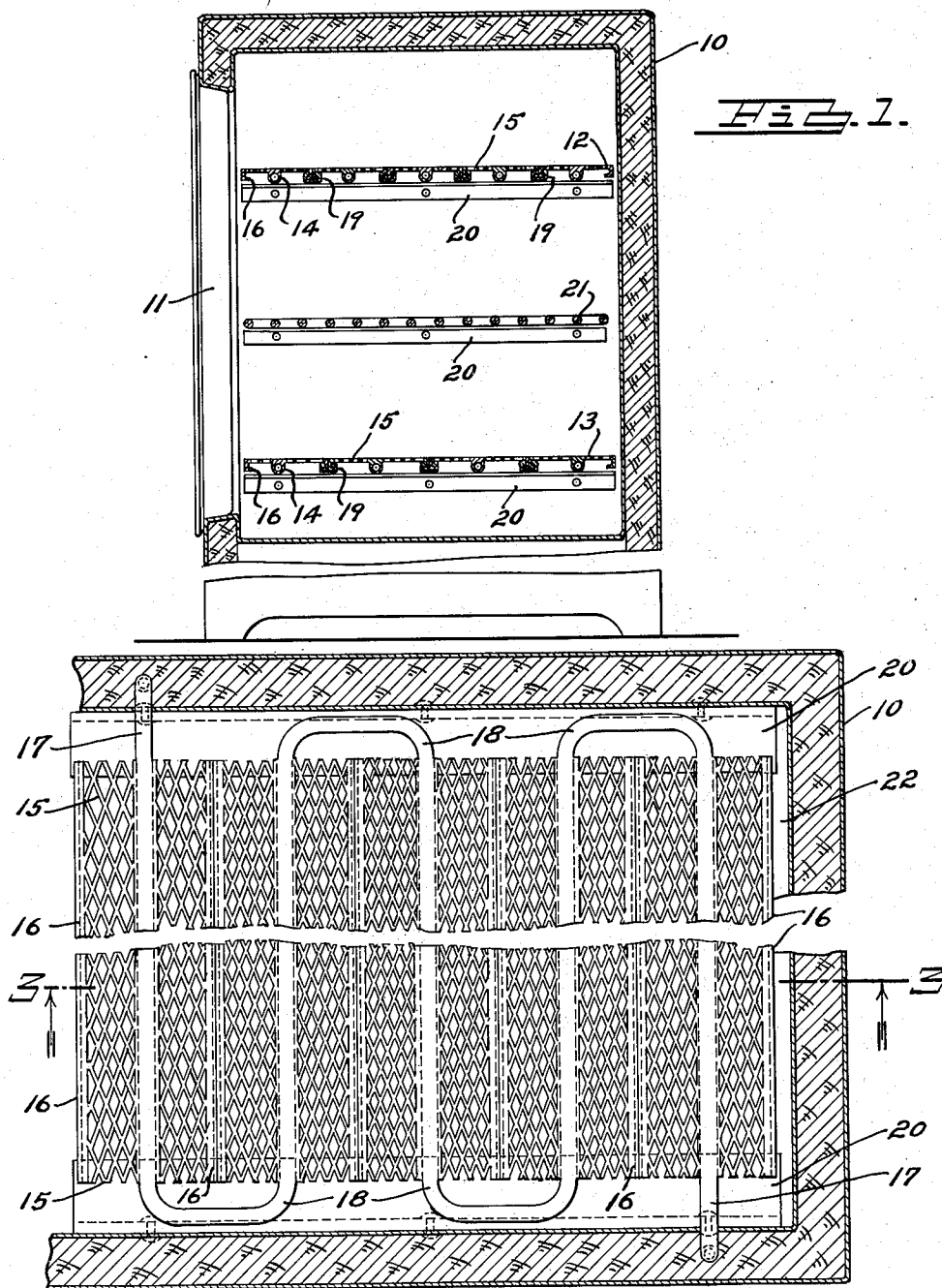


Fig. 2.

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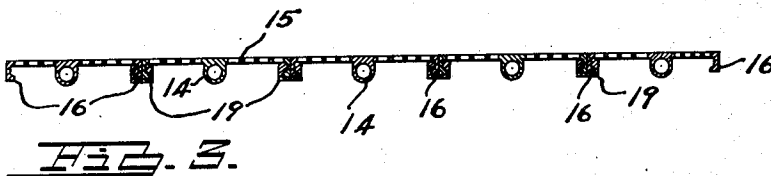
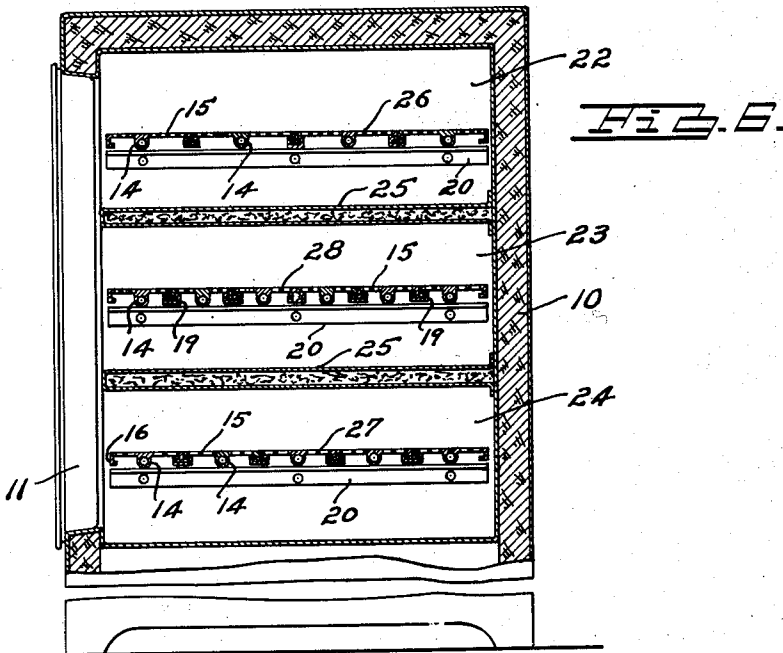
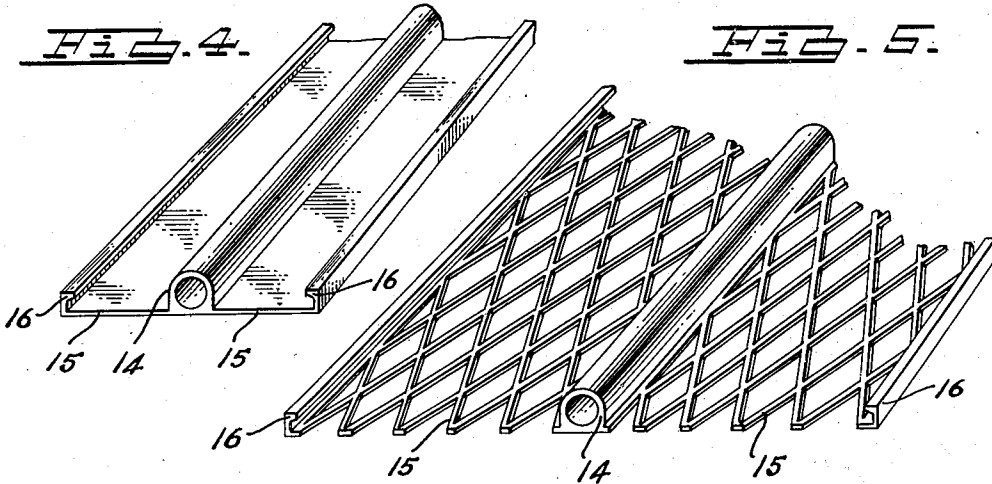
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UNITED STATES PATENT OFFICE

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SHELF EVAPORATOR

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7 Claims. (Cl. 62—99)

This invention relates to the heat exchange art, and particularly to the art of refrigeration.

It has previously been proposed, as in Summers U. S. Patent No. 2,132,836, to cool a refrigerator by an evaporator in the form of a flat element which can be used as a shelf, thus making available for food storage the space that is conventionally taken up by the box type of evaporator.

The present invention improves upon the structure shown in the Summers patent by providing a foraminous evaporator shelf through which air may circulate freely, so that food may rest directly on the cooled shelf while the circulation of air equalizes the temperature throughout the compartment in which the shelf is located.

Another feature of the present invention resides in the provision of shelves with varying spacing of the tubing which carries the refrigerating fluid. In some of the shelves the runs of tubing may be placed close together thus incorporating a relatively great length of the cooling tubing for use where very low temperatures are to be maintained, while in other shelves the runs of tubing may be placed farther apart for use where higher temperatures are desired.

In carrying out this invention each shelf is preferably built up from a single strip of stock having a tube and fins, the fins being foraminous and being expanded to the desired width.

These and other objects and advantages of the invention will become apparent as the description proceeds.

While preferred forms of the invention are disclosed herein for purposes of illustration, various changes may be made in the structure without departing from the spirit of the invention as herein set forth and claimed.

In the drawings:

Fig. 1 is a vertical section through a refrigerator embodying the invention.

Fig. 2 is a plan view partly in section showing one of the shelf evaporators.

Fig. 3 is a section on line 3—3 of Fig. 2.

Fig. 4 is a perspective of a piece of the strip material as originally formed.

Fig. 5 is a perspective of a piece of the strip material after it has been expanded.

Fig. 6 is a vertical section showing another arrangement for utilizing the invention in a refrigerator.

The improved shelf evaporator of this invention is shown in Fig. 1 installed in a refrigerator of the domestic type which comprises a cabinet 10 having a door 11. 12 and 13 are shelf evapo-

rators, the construction of which will be understood more clearly from Figs. 2 to 5 inclusive.

The material from which these evaporator shelves are constructed is the strip stock shown in Fig. 4 which comprises a central tubular portion 14 from which extend lateral fins 15 which terminate in dovetailed flanges 16. The tube 14 and flanges 16 project from one face of the strip, leaving the other face flat. At present I prefer to extrude this stock from aluminum, but it can of course be made by other processes and of other materials suitable for the purpose. The use of a strip of this conformation to construct evaporator units is disclosed in U. S. patent to Higham et al., No. 2,162,083. Prior to the fabrication of this strip into shelf evaporators, the fins 15 are cut with a plurality of slots extending parallel to the tube 14 and arranged in staggered relation to each other, and the two dovetailed flanges 16 are then gripped and pulled apart, thus expanding the fins 15 in a manner well understood in the expanded sheet metal art. The expanded strip has its fins pierced by a plurality of diamond-shaped openings as shown in Fig. 5.

After the fins 15 have been thus expanded to the desired extent, parts of these fins on opposite sides of the tube 14 are removed at each end portion 17 of the strip, and at intermediate portions 18. The intermediate portions 18 are then bent so as to bring the second run of the strip into a position with one of its dovetailed flanges 16 adjacent a dovetailed flange 16 of the first run. Each of the intermediate portions 18 is similarly bent, after which the juxtaposed dovetailed flanges are fastened to each other in any suitable manner, as by pinching over them clip strips 19 according to the teachings of Higham Patent 2,162,083. The strip of material is now in the condition illustrated in Figs. 2 and 3, being in the form of a continuous sheet with a flat surface on the upper side and with the tubes 14 and flanges 16 projecting downwardly from the under side. The tube 14 winds sinuously across the underside of the sheet but forms a continuous conduit free from joints.

The shelf evaporator thus formed may be mounted in a refrigerator in any preferred manner. One advantageous method of mounting the shelf is shown in Figs. 1 and 2 in which the shelf is placed with the runs of tubing 14 extending parallel to the back wall of the refrigerator cabinet. With this arrangement it is possible to support the shelf by securing angle brackets 20 to the side walls of the cabinet in a position to engage under the bent portions 18 and end por-

tions 17 of the tube 14. With this arrangement the tube 14 and dovetail flanges 16 form ribbing to stiffen the shelf on the dimension of its greatest length.

The end portions 17 may be connected in any suitable manner to any preferred type of refrigeration system. In the form illustrated the ends 17 project into the insulated walls of the cabinet where they are connected to the leads of a refrigeration system.

An important advantage of the evaporator shelf of this invention lies in the fact that its foraminous construction permits air to circulate relatively freely through the shelf so that the shelf not only provides efficient cooling contact with objects placed on the shelf, but also provides for the maintenance of a fairly uniform refrigerating temperature throughout the compartment in which the shelf is located.

A refrigerator may be constructed with only a single evaporator shelf, although a plurality of such shelves may be used as indicated at 12 and 13 in Fig. 1. 21 is a conventional wire shelf. The shelf 13 of Fig. 1 has its fins 15 expanded laterally farther than those of shelf 12, and hence there are fewer runs of the tube 14 on the underside of shelf 13. As the result the shelf 13 is not provided with as much refrigeration capacity as shelf 12, and hence can be kept at a higher refrigerating temperature. By thus varying the degree of expansion of the fins on different shelves, it is possible to provide refrigeration zones for different purposes, such as for freezing ice cubes, etc.

In some cases it may be desired to provide a refrigerator with separate compartments in which the temperatures are maintained within different ranges. A construction of this kind is illustrated in Fig. 6 in which compartments 22, 23 and 24 are separated from each other by insulated partitions 25. A shelf evaporator constructed according to this invention is located in each of these compartments. The shelf evaporators in these different compartments can be constructed with varying degrees of expansion as just explained to place a different amount of refrigerating tubing in the different compartments. Thus, as shown in Fig. 6, the shelf evaporator 26 is provided with four runs of tubing 14, the evaporator 27 is provided with five runs, and the evaporator 28 is provided with six runs of the tubing.

Details of the refrigeration system do not form a part of the present invention, and it will be obvious to those skilled in the art that the shelf evaporators can be connected to any preferred control mechanism, such as expansion valves,

multiple control valves, etc., to provide suitable control of the refrigerating medium.

I claim:

1. In a refrigerator of the type having an evaporator shelf, the improvement which comprises; an evaporator shelf formed from a single length of strip having a central tube and laterally extending fins homogeneous with the tube, the fins being removed from the tube at spaced intervals to permit bending the tube back upon itself, a fin of one run being secured to a fin of a contiguous run, the remaining parts of the fins being foraminous to permit circulation of air through the shelf.

2. In an evaporator shelf for refrigerators the improvement which comprises; a shelf formed from a single strip of material having fins homogeneous with a tube, the fins being foraminous to permit circulation of air through the shelf.

3. In an evaporator shelf for refrigerators the improvement which comprises; a shelf formed from a plurality of runs of strip stock, the strip stock including a tube portion and lateral fins homogeneous with the tube portion, the fins being pierced by a plurality of diamond-shaped openings.

4. In an evaporator shelf for refrigerators the improvement which comprises; a shelf formed from a plurality of runs of strip stock, the strip stock including a tube portion and lateral fins homogeneous with the tube portion, the lateral fins ending in side flanges by which adjacent runs are secured together, the fins being pierced by a plurality of diamond-shaped openings.

5. The improvement specified in claim 4 in which the tubes and flanges project from one face of the stock, leaving the other face flat.

6. In a refrigerator of the type in which the temperatures of a plurality of separate compartments are maintained within different ranges by shelf evaporators individual to the compartments, the improvement which comprises; a foraminous evaporator shelf provided with cooling tubes in each compartment between the top and bottom thereof, the tubes on the evaporator shelf in one compartment being more numerous and closer together than the tubes on the evaporator shelf in another compartment.

7. In a refrigerator of the type having a plurality of evaporator shelves, the improvement which comprises shelves having cooling tubing with foraminous fins homogeneous with the tubing, one shelf having runs of cooling tubing spaced closer together and a greater length of cooling tubing than has another shelf.

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